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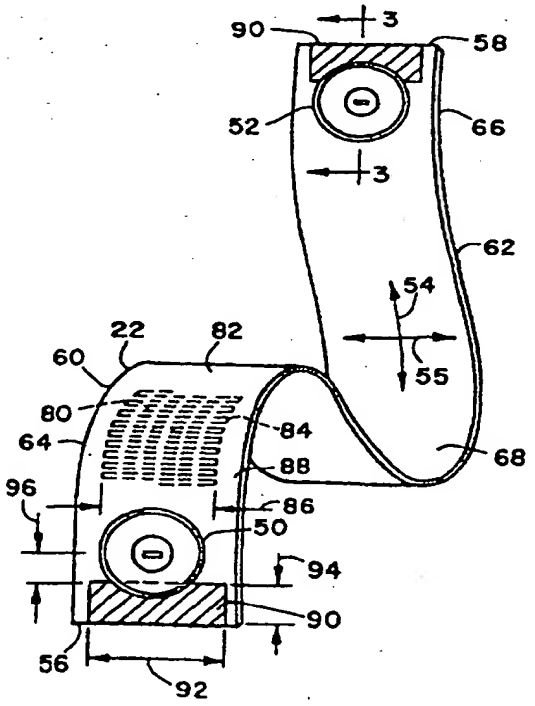
(54) Title: MONOFILAMENT REINFORCED FASTENING SYSTEM FOR ABSORBENT ARTICLES AND METHOD OF MANUFACTURE

(57) Abstract

A fastening system for use with a garment incorporates elastomeric strap members (22) comprising an integral monofilament strand (80) for transverse reinforcement and stability. Buttons (50, 52) adapted for releasable attachment to the garment are bonded to the strap member. Substantially continous end seals (90) that are bontiguous with the end edges of each strap member have a width dimension at least as great as an effective monofilament strand width. Fabric strands of the strap members are bonded to one another in the end seals to substantially immobilize the monofilament strand. Particular features contain the monofilament strand in a manner that reduces the tendency of the ends of the strap members to curl under during use.



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MONOFILAMENT REINFORCED FASTENING SYSTEM FOR ABSORBENT ARTICLES AND METHOD OF MANUFACTURE

BACKGROUND OF THE INVENTION

The present invention relates to an improved fastening system for a garment. More particularly, the invention pertains to an improved elastic strap fastening system with button fasteners that incorporates a monofilament reinforcing strand for improved resistance to side rolling and twisting and end curling. The invention also pertains to absorbent articles and methods of making such fastening systems.

Garments such as absorbent articles come in a variety of forms, which is a result of there being so many different types of wearers and use conditions. Each form of garment incorporates a specifically-designed, compatible fastening system. Fastening systems for absorbent articles, by way of illustration, have included adhesive tapes, garment adhesives, and body adhesives; mechanical hook-and-loop type fasteners; button-type fasteners; stretchable side panels; and the like.

Many of these fastening systems have been improved in recent years as a result of their being the continued subject of intense development efforts. In complete contrast, though, is the elastic strap and button fastener fastening system that has received very little attention since its first use until today. This form of fastening system, which is especially common for adult incontinence undergarments, has been a mainstay of the field but until now has not been similarly improved as have other product features. As a result of the improvements in absorbency, gasketing, materials development, and the like, the

elastic strap and button fastener fastening system has now become a significant factor in wearer dissatisfaction with fit and comfort of the garment.

Therefore, what is lacking and needed in the art is an improved garment fastening system that utilizes elastic straps and button fasteners and that enhances garment fit and wearer comfort.

SUMMARY OF THE INVENTION

In response to the discussed deficiencies in the prior art, a new fastening system including elastic straps and button fasteners has been developed. The fastening system is suitable for use on garments such as absorbent articles and improves both product fit and wearer comfort.

Evaluation of fastening systems with elastic straps has indicated to Applicants that relatively wider elastic straps improve product fit by reducing sagging of the garment and increasing comfort, security, and leakage protection relative to narrower elastic straps. Applicants also recognized, however, that increased strap width tends to directly increase the degree to which the side edges of the strap tend to roll, twist and rope when the elastic is stretched. This problem is attributable to use of a button or other point-attached fastener, because the lines of force when the elastic strap is stretched tend to be directed toward the attachment location, and the sides of the strap tend to fold over about an axis defined by the lines of force.

As can be appreciated, having the side edges of the elastic strap roll and twist can be very uncomfortable and can lead to skin irritation due to localized pressure of the strap. Moreover, rolling of the strap edges can also be detrimental to the fit of the garment and lead to sagging and insecurity. Applicants have discovered that simply increasing the strap tension in an attempt to enhance fit and reduce sagging is not a desirable option, because the higher tensions merely increase the tendency of the strap edges to roll and twist and also decrease wearer comfort by localizing pressure in a small area.

Thus, while Applicants have recognized the benefits to be gained by wider elastic straps, Applicants have also discovered performance characteristics that, in addition to increased product cost, present obstacles to obtaining improved fit and comfort with fastening systems using elastic straps and buttons.

The fastening systems of the present invention overcome the above-referenced obstacles and enable the use of wider elastic straps with button or other point contact fasteners. The fastening systems of the present invention incorporate an elastomeric strap member comprising an integral monofilament strand that provides width-wise reinforcement and thus stability to the strap. In particular, the integral monofilament strand prevents lines of force created by elongation of the elastic strap from causing the side edges of the strap to roll and twist. Further, the monofilament strand is contained within the strap member in a manner that reduces the tendency of the end of the strap to curl under and minimizes the potential for skin irritation.

In one aspect, the present invention concerns a fastening system for use with a garment. The fastening system includes an elastomeric strap member having longitudinal and transverse axes, opposite first and second longitudinal end edges, opposite side edges extending between the end edges, a first end region contiguous with the first end edge, and a second end region contiguous with the second end edge. The elastomeric strap member is formed of a fabric structure comprising a plurality of fabric strands and a monofilament strand that is transversely laid within the fabric structure. A button adapted for releasable attachment to the garment is bonded to the strap member in the first end region, and the second end of the strap member is attachable to the garment. The strap member also includes an end seal contiguous with the first end edge of the strap member. The end seal has a width dimension at least as great as an effective width of the monofilament strand, and the end seal is substantially continuous across its width dimension. The fabric strands are bonded to one another in the end seal and the monofilament strand is substantially immobilized in the end seal.

In another aspect, the invention concerns a fastening system having an elastomeric strap member and first and second buttons bonded to the strap member in respective first and second end regions. The elastomeric strap member is formed of a fabric structure including a plurality of fabric strands and a monofilament strand transversely laid within the fabric structure. The strap member also includes an end seal contiguous with each of the first and second end edges of the strap member. Each end seal has a width dimension at least as great as an effective width of the monofilament strand and is substantially continuous across the width dimension. The fabric strands are bonded to one another in each end seal, and the monofilament strand is substantially immobilized in each end seal.

Fig. 4 representatively shows a front plan view of a test apparatus for determining a deflection resistance value for a specimen taken from one of the two strap members shown in Fig. 1.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

With reference to Figs. 1 and 2, an absorbent article formed according to the invention is shown for purposes of illustration as a disposable undergarment 20 for adult incontinence which is maintained in position about a wearer by a fastening system comprising a pair of strap members 22. As used herein, the term "disposable" includes being disposed of after use and not intended to be washed and reused. The undergarment 20 is shown in Fig. 1 in a relaxed or non-stretched condition, with the strap members 22 only partially attached to the undergarment. The invention may also be embodied in other types of garments, such as other disposable absorbent articles, reusable absorbent articles, or the like.

The illustrated undergarment 20 has opposite, front and back longitudinal end edges 24 and 26, and longitudinal side edges 28 that extend between the longitudinal end edges. The undergarment 20 includes a first or front waist region 30, a second or back waist region 32, and an intermediate, crotch region 34 positioned between and interconnecting the front and back waist regions. The outer edges of the undergarment 20 define a periphery 36 having generally straight end and side edges 24, 26 and 28, although the edges optionally may be curvilinear and contoured.

The front waist region 30 is contiguous with the front end edge 24 and extends longitudinally inward therefrom toward the transverse center line of the undergarment 20. The back waist region 32 is contiguous with the back end edge 26 and extends longitudinally inward therefrom toward the transverse center line. The waist regions 30 and 32 comprise those upper portions of undergarment 20 which, when worn, wholly or partially cover or encircle the waist or mid-lower torso of the wearer. The intermediate, crotch region 34 comprises that portion of undergarment 20 which, when worn, is positioned between the legs of the wearer and covers the lower torso of the wearer. Thus, the crotch region 34 is the area where insults of urine typically occur in the undergarment or other disposable absorbent article.

The undergarment 20 includes a substantially liquid impermeable moisture barrier 40, an absorbent assembly 42 disposed on the moisture barrier, and a substantially liquid permeable bodyside liner 44 bonded to the moisture barrier to sandwich the absorbent assembly therebetween. The moisture barrier 40 and bodyside liner 44 are desirably longer and wider than the absorbent assembly 42 so that the peripheries of the moisture barrier and bodyside liner may be bonded together using ultrasonic bonds, thermal bonds, adhesives, or other suitable means. The peripheries of the moisture barrier 40 and the bodyside liner 44 typically form the side and end margins of the undergarment 20. The absorbent assembly 42 may be bonded directly to the moisture barrier 40 and/or the bodyside liner 44 using ultrasonic bonds, thermal bonds, adhesives, or other suitable means. As used herein, the term "bonded" refers to the joining, adhering, connecting, attaching, or the like, of two elements. Two elements will be considered to be bonded together when they are bonded directly to one another or indirectly to one another, such as when each is directly bonded to intermediate elements. The terms "disposed," "disposed on," "disposed with," "disposed at," "disposed near" and variations thereof are intended to mean that one element can be integral with another element, or that one element can be a separate structure bonded to or placed with or placed near another element.

The moisture barrier 40 desirably comprises a material that is formed or treated to be liquid impermeable. Alternatively, the moisture barrier 40 may comprise a liquid permeable material and other suitable means may be provided to impede liquid movement away from the absorbent assembly, such as a liquid impermeable layer (not shown) associated with the absorbent assembly 42. The moisture barrier 40 may also be gas permeable, such that gases encountered during use of the absorbent garment are able to pass through the material under ordinary use conditions, over either all or part of its surface area.

The moisture barrier 40 may comprise a single layer of material or a laminate of two or more separate layers of material. Suitable moisture barrier materials include films, wovens, nonwovens, laminates of films, wovens, and/or nonwovens, or the like. For example, the moisture barrier 40 may comprise a thin, substantially liquid impermeable web or sheet of plastic film such as polyethylene, polypropylene, polyvinyl chloride or similar material. The moisture barrier material may be transparent or opaque and have an embossed or matte surface. One particular material for the moisture barrier 40 is a polyethylene film that has a nominal thickness of about 0.025 millimeter and a systematic

The fastening system in the illustrated embodiment includes a pair of strap members 22 that are releasably attached to the front and back waist regions 30 and 32 to support the undergarment 20 about the body of the wearer. Attachment systems of this general type are disclosed in U.S. Patent B1 4,315,508 to Bolick, which is incorporated herein by reference. The present fastening system, which will now be described in greater detail, is designed to prevent rolling and twisting of the sides of the strap members 22 and prevent curling of the ends of the strap members during use. These improvements enable the use of relatively wide straps if desired, as well as improving comfort and fit of the garment.

Each strap member 22 in the illustrated embodiment is provided with first and second buttons 50 and 52 that are adapted to be releasably attached to button holes 53 provided in the undergarment 20. The button holes 53 are desirably formed in the moisture barrier 40 and bodyside liner 44, and may additionally comprise button hole reinforcement tapes (not shown) as is well known in the art. As used herein, the terms "releasably attached," "releasably engaged" and variations thereof refer to two elements being connected or connectable such that the elements tend to remain connected during use absent the wearer applying a unique separation force to one or both of the elements, and the elements being capable of separation without substantial permanent deformation or rupture.

The strap members 22 are each generally rectangular strips of material which define a longitudinal axis 54 and a generally perpendicular transverse axis 55 (Fig. 2). Each strap member 22 has opposite, longitudinally spaced first and second end edges 56 and 58, and opposite side edges 60 and 62 extending between the end edges. The size of the strap members 22 will vary depending on the type of garment to which they are attached and the size of the intended wearers. The distance between the end edges 56 and 58 defines the strap length, which is suitably from about 15 to about 40 cm. The distance between the side edges 60 and 62 defines the strap width, which is desirably at least about 25 mm., and more particularly at least about 30 mm. for improved performance. In one particular embodiment, each strap member 22 has a length dimension of 28.6 cm. and a width dimension of 38 mm.

For purposes of the present invention, the strap members 22 are considered as being divided longitudinally into a first end region 64, a second end region 66 and a

central region 68 that is intermediate and interconnecting the first and second end regions. The first end region 64 is contiguous with the first end edge 56 and extends longitudinally inward therefrom to the central region 68. The second end region 66 is contiguous with the second end edge 58 and extends longitudinally inward therefrom to the central region 68.

Fig. 3 represents an enlarged section view taken generally from a plane of line 3-3 in Fig. 2, but taken slightly off center to illustrate attachment of the buttons 50 and 52. The buttons 50 and 52 are bonded to the respective first and second end regions 64 and 66 of each strap member 22 at attachment locations 70 (Fig. 3). An attachment location 70 is defined by the location at which a thread 72 or other suitable means bonds a button 50 or 52 to the strap member 22. The thread 72 is illustrated as passing through sewing holes 74 in the buttons 50 and 52 and passing through the strap member 22.

In the illustrated embodiment, the buttons 50 and 52 have an upper, contoured surface 76 and an opposite, generally flat lower surface 78. Buttons 50 and 52 suitable for use with the present invention may be formed of polypropylene and have a diameter of 22 mm., such as those available from Engineering Industries of Verona, Wisconsin, and identified as a green membrane button. In the illustrated embodiment, both end regions 64 and 66 of each strap member 22 may be attached to the undergarment 20 with the buttons 50 or 52. Alternatively, however, one end of each strap member 22 could be formed integral with the undergarment 20 or bonded thereto by other suitable means (not shown).

The term "button" is used herein to refer to a group of fasteners that can be attached to the strap members 22 at a point or an otherwise relatively small region in relation to the width dimension of the strap member. Examples of such fasteners include buttons, snaps, hook eyes, or the like. More particularly, such fasteners have an attachment location constituting less than about 40 percent of the width dimension of the strap member 22, and more particularly less than about 30 percent of the width dimension of the strap member.

Applicants have determined that these fasteners share a common problem, which is that when the elastic strap member 22 is elongated, lines of force are formed within the strap member that are directed at a gradual angle from the side edges 60 and 62 of the strap longitudinally outward and transversely inward toward the attachment location 70 of

the fastener. In essence, the strap member 22 "necks down" near the attachment location 70. When the strap member 22 is positioned against the body of the wearer, the side edges 60 and 62 of the strap member tend to fold about an axis defined by the lines of force. As noted previously, these folded sides would represent an irritant to the wearer because the strap forces would be concentrated in a smaller area, and they would also adversely impact the fit of the undergarment. The present invention concerns the recognition of this problem and the incorporation of an integral reinforcing material within the strap member 22 to provide improved elastic strap members with button fasteners.

The strap members 22 are formed of an elastomeric material that is adapted to provide a relatively high degree of elasticity in the longitudinal direction 54 and a relatively high degree of dimensional stability in the transverse direction 55. The terms "elastic," "elasticized" and "elasticity" as used herein refer to that property of a material by virtue of which it tends to recover its original size and shape after removal of a force causing a deformation. The term "elastomeric" refers to a material or composite which can be elongated by at least 25% of its relaxed length and which will recover, upon release of the applied force, at least 10% of its elongation. It is generally preferred that the elastomeric material be capable of being elongated by at least 100%, and more preferably by from 150 to 350%, of its relaxed length and recover, upon release of an applied force, at least 50% of its elongation. The term "force" refers to a physical influence exerted by one body on another which produces acceleration of bodies that are free to move and deformation of bodies that are not free to move.

In order to provide the desired dimensional stability in the transverse direction 55, each strap member 22 comprises at least one relatively stiff monofilament strand 80 disposed within a surrounding fabric structure 82 of the elastic material. The monofilament strand 80 is laid in the fabric structure 82 in a sinusoidal manner between adjacent courses as the fabric is made. A portion of the length of the monofilament strand 80 is illustrated in Fig. 2, although it should be appreciated that the strand 80 extends the full length of the strap member 22 and forms an integral component of the elastomeric strap material.

The monofilament strand 80 suitably has a greater relative stiffness than strands of the remaining fabric structure 82. In particular embodiments, the monofilament strand 80 is composed of nylon yarn, but alternatively may comprise any synthetic or natural strands that provide relatively greater stiffness than the remaining fabric structure 82. The strap

members 22 may comprise one or a plurality of monofilament strands 80. For instance, in one embodiment, the strap members 22 comprise one nylon monofilament strand of about 80 denier and one nylon monofilament strand of about 330 denier. Suitable monofilament strands 80 are available from Shakespeare Monofilament company of Columbia, South Carolina, under the tradename SHAKESPEARE®. The monofilament strands 80 provide transverse stability to the strap members 22 over the full strap length, and as a result, prevent rolling and twisting of the straps between the buttons 50 and 52 when elongated during use.

In one aspect of the present invention, the monofilament strand 80 does not extend across the entire strap width. Rather, the monofilament strand 80 changes directions at reversal points 84 that are disposed transversely inward of the side edges 60 and 62 of the strap member 22. The monofilament strand 80 thus has an effective width between opposite reversal points 84 that is less than the strap width. In Fig. 2, the effective width of the monofilament strand 80 is illustrated by arrow 86. Buffer zones 88 of the strap member 22 are thus provided between the reversal points 84 of the monofilament strand 80 and the corresponding side edges 60 and 62 (Figs. 2 and 3). The buffer zones 88 provide relatively more flexible portions of the strap member 22 that are generally more comfortable against the body of the wearer. Examples of fabrics containing inwardly reversing monofilament yarns are disclosed in U.S. Patents 4,244,199 issued January 13, 1981 to Rhode and 4,631,932 issued December 30, 1986 to Sommers, which patents are incorporated herein by reference. The effective width 86 is suitably from about 50 to 100 percent of the width dimension of the strap members 22, and particularly from about 70 to about 95 percent for improved performance, such that the buffer zones 88 have a width of from about 2 to about 10 mm.

The strap members 22 may comprise any suitable fabric structure 82 for containing the monofilament strand 80. The strap member 22 may comprise, for example, woven, knit, crotchet knit, or other suitable surrounding fabric structures. Suitable fabric structures 82 may comprise relatively inelastic yarns, relatively elastic yarns, relatively stiff monofilament yarns 80, and covering yarns. The relatively inelastic yarns and covering yarns are typically formed of polyester, nylon or other flexible synthetic or natural yarn materials. The relatively elastic yarns are typically formed of rubber, neoprene or spandex yarn materials.

In particular embodiments, the strap members 22 comprise a lock knit fabric formed of 150 denier polyester weft, warp and lock knit single yarns; 50 gauge (3311 denier) neoprene elastic stands; white nylon cover strands consisting of four 70 denier yarns; and monofilament strands 80. The nylon cover strands are disposed toward the bodyside of the strap member 22 opposite the buttons 50 and 52 to provide a plush surface. The strap material contains about 73.8 grains per yard polyester fiber in the weft; about 153.6 grains per yard collectively in the warp and lock knit; and about 67.8 grains per yard of the neoprene elastic. Strap members 22 of the foregoing type are produced by Shelby Elastics, Inc. of Shelby, North Carolina, under the trade designation KCM2. Other suitable materials for the strap member 22 may include different amounts of the foregoing materials, include alternative materials, or be formed by other fabrication methods.

Applicants have discovered that the ends of the elastomeric strap members 22 longitudinally outward of the button attachment locations 70 have a tendency to curl under during use. As a result, the end edges 56 and 58 are trapped between the body of the wearer and the remainder of the strap member 22, or project at an angle toward the body, and become a source of irritation. Incorporation of a monofilament strand 80 in the strap member 22 would exacerbate this problem, due to the cut ends of the rigid monofilament strand protruding from the ends 56 and 58 of the strap member and poking the skin, were it not for the Applicants' solution described below.

In one aspect, the invention pertains to the use of end seals 90 to substantially immobilize the monofilament strand 80. The end seals 90, which are illustrated in Figs. 1 - 3 as cross-hatched regions, are present at both ends of the strap member 22 contiguous with each end edge 56 and 58. As best shown in Fig. 2, the end seals 90 have a width dimension represented by arrow 92 that is parallel to the transverse axis 55 of the strap member 22 and a length dimension represented by arrow 94 (also Fig. 3) that is parallel to the longitudinal axis 56 of the strap member. The width dimension 92 of each end seal 90 is suitably equal to or greater than the effective width 86 of the monofilament strand 80 (Fig. 2). Additionally, the width dimension 92 is desirably although not necessarily less than the strap width.

To effectively contain the monofilament strand 80, the end seals 90 are substantially continuous across their entire width dimension 92 so that the strand 80 is immobilized at the end edges 56 and 58 of the strap member 22 regardless of the location at which the strap member is cut. The term "substantially continuous" as used herein in reference to

an end seal 90 means that the end seal is free of gaps or interruptions that would allow the monofilament strand to protrude from the end edges 56 and 58, and desirably free of gaps or interruptions that are equal to or greater than the diameter of a monofilament strand, optically measured at the end edge 56 and 58.

The end seals 90 may be formed by ultrasonic bonding, adhesive injection, thermal bonding, ultrasonic cutting, laser cutting, or other suitable means. One significant feature of the end seals 90 is that the fabric structure 82 surrounding the monofilament strand 80 is bonded to itself to substantially restrict or prevent movement of the monofilament strand. By doing so, the monofilament strand 80 is unable to protrude past the cut end edges 56 and 58 and poke the wearer during use. The monofilament strand 80 may also be bonded to the fabric structure 82 in the end seals 90 to further immobilize the strand 80.

In one embodiment, the end seals 90 are formed by ultrasonically bonding a portion of the strap member 22 to form the end seals 90. The ultrasonic bonding process causes the fabric structure 82 to melt adhere to itself. The term "melt adhere" is used herein to mean that individual fibers comprising the fabric structure 82 have been processed to their softening point and allowed to bond directly to other fibers of the fabric structure. Alternatively, the fabric structure 82 may be bonded to itself and/or to the monofilament strand 80 by adhesive bonds, chemical bonds, mechanical bonds, thermal bonds, or the like to immobilize the monofilament strand.

Another aspect of the invention pertains to the ability of the end seals 90 to resist curling under during use. Applicants have determined that the ends of elastic straps 22 containing monofilament strands 80 tend to resist curling under when the end seals 90 are adapted to have a deflection resistance value of at least about 200 grams, and particularly when in combination with the end seals having a length dimension 94 of greater than 3 mm. The deflection resistance of the end seal 90 measures the amount of resistance to bending that is provided by the portion of the strap member 22 contiguous with an end edge 56 or 58. Within the above parameters, the ends of the strap members 22 tend to lay flat on the body of the wearer, thereby reducing a source of irritation.

The deflection resistance values of the end seals 90 are more particularly at least about 300 grams, and beneficially more than 400 grams, for improved performance. The deflection resistance of an end seal 90 may be altered by modifying the composition of the

strap member 22, changing the number or weight of the monofilament strands 80, varying the width and length dimensions 92 and 94 of the end seal, adjusting the degree of bonding of fibers in the end seal, or the like. A suitable procedure for determining deflection resistance is set forth in greater detail hereinafter.

The end seals 90 are desirably contiguous with the end edges 56 and 58, substantially continuous across the width dimension 92, and have a length dimension 94 of greater than 3 mm. In particular embodiments, the end seals 90 have a length dimension 94 of at least about 10 mm, such as from about 10 to about 16 mm, for improved performance. The end seals 90 are also substantially continuous across the length dimension 94. Furthermore, the end seals 90 are desirably longitudinally spaced from the attachment locations 70 of the buttons 50 and 52 by a gap illustrated by arrow 96 in Fig. 2 of not more than about 10 mm., and more particularly not more than about 6 mm., such as from 0 to about 6 mm., for improved performance. Applicants have determined that the strap ends are more likely to curl under as the size of the gap 96 is increased.

The present end seals 90 differ significantly from those employed on conventional elastic straps of commercial disposable absorbent undergarments. Initially, it is noted that Applicants have not identified any disposable absorbent undergarments that incorporate a monofilament strand, and therefore the end seals employed on commercial products are thought to be different in the basic respect that they do not incorporate a monofilament strand. It is believed that conventional undergarment straps do not combine the following features: (1) the end seal being contiguous with the end edge of the strap member; (2) the end seal being substantially continuous over the width of the end seal; and (3) the end seal having a length of greater than about 3 mm. Further, it is also believed that conventional undergarment straps do not combine the following features: (1) the end seal being contiguous with the end edge of the strap member; (2) the end seal being substantially continuous over the width of the end seal; and (3) the end seal being located not more than about 10 mm. from the button attachment location. For purposes of comparison, the straps from five commercially available disposable absorbent undergarments were examined and the results are described below.

The first undergarment was representative of those sold by Kimberly-Clark Corporation of Neenah, Wisconsin, in about January of 1996 under the tradename DEPEND®. The straps had end seals that were contiguous with the end edges of the

straps. Each end seal had a length of about 9.5 mm. and comprised a series of bar-shaped ultrasonic bond areas. The end seals were located within 4.5 mm. from the button attachment locations. The strap fibers were melt adhered to one another in the bond areas. Rather than being substantially continuous across the width of each end seal, the bond areas comprised only about 50 percent of the width of each end seal.

The second undergarment examined was commercially available from Osco Drug and manufactured by Pope & Talbot of Portland, Oregon. The undergarment was purchased in January of 1995 under an Osco Drug brandname. The straps had end seals that were contiguous with the end edges. The end seals had a length of about 0.4 mm.; were continuous across the full width of the straps; and were located 15 mm. from the button attachment locations. The strap fibers did not appear to be melt adhered to one another.

The third undergarment examined was commercially available from Wal-Mart and manufactured by Inbrand Corporation of Marietta, Georgia. The undergarment was purchased in January of 1996 under the tradename ASSURANCE™. The straps had end seals that were contiguous with the end edges. The end seals had lengths ranging from about 0.4 to 0.8 mm.; were continuous across the full width of the straps; and were located 15 mm. from the button attachment locations. The strap fibers did not appear to be melt adhered to one another.

The fourth undergarment examined was commercially available from Walgreen Drug Stores and manufactured by ICD Industries of King of Prussia, Pennsylvania. The undergarment was purchased in January of 1996 under the tradename Walgreen Belted Undergarments. The straps had end seals that were contiguous with the end edges. The end seals had lengths ranging from about 0.4 to 0.8 mm.; were continuous across the full width of the straps; and were located 15 mm. from the button attachment locations. The strap fibers did not appear to be melt adhered to one another.

The fifth undergarment examined was commercially available from Access Medical and manufactured by The Procter & Gamble Company of Cincinnati, Ohio. The undergarment was purchased in January of 1996 under the tradename ATTENDS®. The straps had end seals that were contiguous with the end edges. The end seals had a length of about 0.8 mm.; were continuous across the full width of the straps; and were

located 15 mm. from the button attachment locations. The strap fibers did not appear to be melt adhered to one another.

Applicants have determined that incorporation of the monofilament strands 80 within the strap members 22 prevents substantial force vectors from being directed from the side edges 60 and 62 at a gradual angle toward the attachment locations 70 of the buttons 50 and 52. By interrupting these inwardly-directed force vectors, the tendency of the side edges of the strap members 22 to twist and roll is greatly reduced or eliminated. Applicants have also determined that end seals 90 that are contiguous with the end edges 56 and 58 and substantially continuous across a width dimension 92 that is equal to or greater than the effective width 86 of the monofilament strand 80 will immobilize or entrap the monofilament strand to prevent it from protruding from the end edges and poking the wearer. Further, Applicants have determined that the ends of strap members 22 will resist curling under when the end seals 90 that are contiguous with the end edges 56 and 58 and have a length dimension 94 of greater than 3 mm., and desirably a deflection resistance value of at least about 200 grams. Applicants have also determined that the ends of the strap members 22 will resist curling under when the end seals 90 are spaced from attachment locations 70 of the buttons 50 and 52 by a gap 96 of not more than about 10 mm.

In use, the undergarment 20 is positioned on the body of the wearer and secured in position using the fastening system. The wearer can engage one button 50 or 52 of each strap member 22 with a button hole 53 in the back waist region 32. After stretching or relaxing the strap members 22 to obtain the desired tension therein, the wearer can then engage the opposite button 50 or 52 of each strap member with one of the corresponding button holes 53 in the front waist region 30. During application of the strap members 22 and during use, the transverse stabilization of the strap members 22 provided by the monofilament strand 80 prevents force vectors within the strap member from being formed at an angle from the side edges 60 and 62 toward the attachment locations 70 of the buttons 50 and 52. The propensity of the side edges of the strap members 22 to roll and twist is thereby minimized or eliminated. The end seals 90 according to the present invention immobilize the monofilament strand 80 within the fabric structure 82 to eliminate a potential source of irritation and also reduce curling of the strap ends to eliminate another source of irritation.

Each of the foregoing or similar embodiments of the invention may be constructed by providing each of the individual components and bonding them together in the manner set forth above. The strap members 22 are desirably formed in a process that begins by providing a continuous web of elastomeric strap material. The material comprises a fabric structure 82 and a monofilament strand 80 transversely laid within the fabric structure in a sinusoidal manner. The web is advanced in an intermittent mode to an end seal forming station for processing. Discrete regions of the continuous web are treated at the forming station, such as by ultrasonic bonding, heat, adhesives, or the like, to form a plurality of bond areas wherein the fabric structure 82 is bonded to itself and/or to the monofilament strand 80 to immobilize the monofilament strand 80. Each of the bond areas desirably has a length of at least 6 mm. The continuous web is then transversely cut through the bond areas to form a plurality of strap members 22. As a result of the cutting, each cut portion of the bond area defines an end seal 90 contiguous with each end edge 56 and 58 of the strap member 22. Each end seal 90 desirably has a length of at least 3 millimeters and a deflection resistance value of greater than 200 grams. Buttons 50 and 52 are bonded in place to complete manufacture of each strap member 22.

In one embodiment, the method employs ultrasonic bonding equipment to form the end seals 90. One suitable ultrasonic thruster system is available from Dukane Corporation, Ultrasonics Division, of St. Charles, Illinois. The unit is identified as a 2000 watt, 220 DPC system referred to as model No. 2200C220T, with a 2.0:1 gain titanium booster mounted to a titanium horn, part No. 25952. The horn has working face dimensions of 28.5 by 41.1 mm. and an extra fine male knurl pattern over the entire working face to improve weld time and quality. The thruster system is mounted in a frame so that the horn when retracted is spaced from a mating anvil by a gap of 19.1 mm. The anvil has a working face of 31.8 by 44.5 mm.

For ultrasonic bonding, the elastomeric strap material is suitably maintained stationary for a brief period, such as less than about 790 milliseconds. Once the material is stationary, the thruster system is activated to advance the horn toward the anvil at 45700 kilograms per square meter force (65 psi) until the horn face contacts the elastomeric strap material. The horn continues advancing until 17578 kilograms per square meter force (25 psi) have been applied to the material. At this point, the ultrasound is activated for a sufficient ultrasound on time and with sufficient energy to form the desired bond area. The thruster system then retracts the horn. Formation of suitable end seals 90 of the type described herein may involve activation of the ultrasound

for intervals of about 375 to 550 milliseconds and application of from about 300 to 400 joules weld energy to the material. For strap material having one side that is relatively more plush, the plush surface is desirably positioned toward the anvil for a softer surface against the body.

In particular embodiments, the ultrasonic thruster system is adapted to form a plurality of bond areas in the continuous web of elastomeric strap material. The bond areas have a length dimension of about 25.4 mm. and a width dimension equivalent to the strap width. The bond areas are thereafter cut in half using a mechanical knife.

Cutting the strap members 22 may be accomplished by a variety of mechanisms, such as shear cutting, ultrasonic cutting, laser cutting, water cutting, or the like. Shear cutting is believed to generally produce straighter end edges 56 and 58 than ultrasonic cutting, and straighter edges are believed to produce less skin irritation.

Having thus described the present invention and the process for making it, a number of examples were prepared to give a more detailed understanding of the invention. These examples and the test procedures for measuring them are set forth below. The particular amounts, proportions, compositions and parameters are meant to be exemplary, and are not intended to specifically limit the scope of the invention.

TEST PROCEDURES

The deflection resistance test measures the peak load as a test specimen taken from a strap member 22 is deflected about an axis parallel to the longitudinal or length dimension of the strap member and centered in the width dimension. The test employs a Sintech material test system, also know as a tensile tester. An appropriate test system is the Model 1/S available from MTS Systems Corporation of Eden Prairie, MN. The material test system is provided with an appropriately sized load cell, for example, a 4.54 kgm. (10 lb.) load cell available from MTS Systems Corporation. The material test system is operated using suitable control software, for example, TEST WORKS® version 3.03 for WINDOWS® available from MTS Systems Corporation.

With reference to Fig. 8, a test specimen 120 is illustrated in proper position for testing in the material test system 122. The material test system 122 includes upper and lower pneumatic grips 124 and 126 that are vertically movable relative to one another.

The upper pneumatic grips 124 include an opposed pair of rubber-coated grip facings 130. The grip facings 130 are adapted to move toward one another through the action of pneumatic cylinders 132. As illustrated, a rigid metal plate 134 is held in place as a result of being pressed between the grip facings 130. The metal plate measures 105 mm. in length, 80 mm. in width, and 1 mm. in thickness. The metal plate 134 is positioned so that the width dimension of the plate is parallel to the direction of movement of the upper and lower pneumatic grips 124 and 126.

The lower pneumatic grips 126 include an opposed pair of rubber-coated grip facings 140. The grip facings 140 of the lower pneumatic grips 126 are controlled by pneumatic cylinders (not shown) that are maintained in a retracted position for this test. The spacing between the two halves of the lower pneumatic grips 126 is illustrated by arrow 142 and is maintained at 21 mm. The distance between the grip facings 140 of the lower pneumatic grips 126 is illustrated by arrow 144 and is maintained at 11 mm.

The test specimen 120 is cut from the strap member 22 using a scissors or the like, in the following manner. The width of the test specimen 120 is 21 mm. and is measured parallel to the width dimension of the strap member 22. The 21 mm. width of the test specimen 120 is thus cut from the middle of the strap member 22, centered between the side edges 64 and 66. The length dimension of the test specimen 120 is taken from the portion of the strap member 122 contiguous with the end edges. The length of the test specimen 120 is the length of the end seal. Any buttons 50 or 52 that are bonded to the test specimen 120 are removed with a scissors or knife prior to testing.

The deflection resistance test is begun by calibrating and preparing the equipment as specified by the manufacturer. The test specimen 120 is positioned in the lower pneumatic grips 126 with the former non-bodyside disposed toward the metal plate 134. The test specimen 120 is oriented such that the 21mm. width dimension is perpendicular to the plane of the metal plate 134. The edges of the test specimen 120 are allowed to rest on the top surfaces of the grip facings 140 of the lower pneumatic grips 126.

During the test, the lower pneumatic grips 126 are maintained stationary while the upper pneumatic grips 124 are moved vertically relative thereto. The metal plate 134 is squared as much as possible relative to the test specimen 120 and lowered until the metal plate almost touches the test specimen. At this time, the control software is initiated. In general, the upper pneumatic grips 124 are lowered at a rate of 5.08 cm. per minute to a

distance of 2 cm. and then returned to their original position. The peak load measured by the load cell is recorded and represents the deflection resistance value for that test specimen 120. The control software program is reprinted below. For purposes of clarity, inactive Result Calculation lines have been omitted.

Master Name: COMPRES
Method Name: strapcomp
Software Version: 3.03

Method Description:
Standard for COMPRESSION TESTS

This Standard contains the most common results calculations required for compression testing application. Among the ASTM tests that can be performed using this Standard include D695, E9, & C185.

Start of Test Messages:
Start of Test Message 1
Start of Test Message 2
Start of Test Message 3
Start of Test Message 4

Pre-Sample Messages:
Pre-Sample Message #1
Pre-Sample Message #2
Pre-Sample Message #3

Pre-Specimen Messages:
Pre-Specimen Message #1
Pre-Specimen Message #2
Pre-Specimen Message #3

Graphics Window, Y-Axis:

Y Axis Scaling Max	MANUAL
Y Axis Scaling Min	MANUAL
Y-Axis Label	LOAD

Y-Axis units	Gm
Y-Axis Min	0.000000
Y-Axis Max	10000.000000
Decimals	1

Graphics Window, X-Axis:

X Axis Scaling Max	MANUAL
X Axis Scaling Min	MANUAL
X-Axis label	EXTENSION
X-Axis units	mm
X-Axis Min	0.000000
X-Axis Max	20.000000
Decimals	1
X Offset	0.000000

Test Flow:

Method Access Level	[9]
Specimens per Sample	[999]
Speed Increment	[0.100000]
Show Graph	[Y]
Show Results	[Y]
Take Data During Pause	[N]
Auto Sample Increment	[N]
Auto Raw Data Save	[N]
Auto Reject on Limits	[N]
Auto Sample Print	[N]
Discard on Reject	[Y]
Auto Comment	[N]
Auto Sample Upload	[N]
Auto Crosshead Return	[N]
Gage Removal	[N]
Pause for Gage Removal	[N]

Reference Name:

Reference Loaded: NONE

Configuration:

Load Direction	DOWN
Extension Direction	DOWN
Compliance	No
End Of Test Action	STOP
Method Type	STANDARD

Move Segments:

Type	RESET EXTENSION
Status	ENABLE
Direction	NO CHANGE
Aquisition	INACTIVE
Data Points	0
End Action	CONTINUE
Message	

Type	TARE STRAIN 1
Status	DISABLE
Direction	NO CHANGE
Aquisition	INACTIVE
Data Points	0
End Action	CONTINUE
Message	

Type	TARE STRAIN 2
Status	DISABLE
Direction	NO CHANGE
Aquisition	INACTIVE
Data Points	0
End Action	CONTINUE
Message	

Type	GO TO STRAIN @ CONSTANT SPEED
Status	ENABLE

Direction	DOWN
Aquisition	ACTIVE
Data Points	500
End Action	CONTINUE
Message	Initial Speed to %strain point

Type	GO TO STRAIN @ CONSTANT SPEED
Status	ENABLE
Direction	DOWN
Aquisition	ACTIVE
Data Points	499
End Action	CONTINUE
Message	Secondary Speed to %strain point

Sample Inputs:

#	Label	Default	Attribute
0	User Input 1	User Default 1	OPTIONAL
1	User Input 2	User Default 2	OPTIONAL
2	User Input 3	User Default 3	OPTIONAL
3	User Input 4	User Default 4	OPTIONAL
4	User Input 5	User Default 5	OPTIONAL
5	User Input 6	User Default 6	OPTIONAL
6	User Input 7	User Default 7	OPTIONAL
7	User Input 8	User Default 8	OPTIONAL
8	User Input 9	User Default 9	OPTIONAL
9	User Input 10	User Default 10	OPTIONAL

Sample Naming Format:

Alias	Sample ID	Length =	30
Alias		Length =	0
Alias		Length =	0
Alias		Length =	0
Alias		Length =	0

Channel Mapping:

#	Label	Units Class	Status	Formula	
[0]	EXTENSION	DIMENSION	ACTIVE	P0	(Primary Strain)
[1]	TIME	TIME	ACTIVE	P1	
[2]	LOAD	LOAD	ACTIVE	P2	
[3]	LOGICAL 3	DIMENSION	INACTIVE	P3	(Secondary Strain)
[4]	LOGICAL 4	LOAD	INACTIVE	P4	

Report Header:

Strap Stiff
Compression Load (g)

Built In Reports:

Built-In Report #0	Built-In 1
Print Header	Y
Print Sample Info	Y
Print Individual Specimens	Y
Print Stats	N
Print Calc Inputs	Y
Print Test Inputs	Y
Print Comments	N

Built-In Report #1	Built-In 2
Print Header	Y
Print Sample Info	Y
Print Individual Specimens	Y
Print Stats	Y
Print Calc Inputs	Y
Print Test Inputs	Y
Print Comments	Y

Display Units:

Load	Lb
Extension	In
Speed	In/Min
Area	Sq.In

Strain	%
Time	Min
Stress	PSI

Specimen Inputs:

#	Label	Units	Default	Attribute	Panel Input	Reference
0	Diameter	In	0.500	HIDDEN	N	
1	Length	In	0.125	HIDDEN	N	
2	Height	In	2.00	HIDDEN	N	Rslt 10,21
3	Area	Sq.In	2.00	HIDDEN	N	
4	Misc.Input 1	(none)	1.00	HIDDEN	N	
5	Misc.Input 2	(none)	1.00	HIDDEN	N	
6	Misc.Input 3	(none)	1.00	HIDDEN	N	
7	Misc.Input 4	(none)	1.00	HIDDEN	N	

Calculation Inputs:

#	Label	Units	Default	Attribute	Panel Input	Reference
0	Gage Length	In	2.00	DISPLAY	N	Req. 2,2,3,9
1	Bonded Gage	In/In	1.00	OPTIONAL	N	
2	Removal Point	In	1.00	OPTIONAL	N	
3	Brk % Drop	%	10.0	OPTIONAL	N	Req 3
4	Brk Drop Elong	In	0.001	OPTIONAL	N	
5	Brk Load Value	Lb	50.00	OPTIONAL	N	
6	Yield Angle	deg	0.00	OPTIONAL	N	
7	Yield % SegLen	%	10.00	OPTIONAL	N	
8	Slope Tol.	%	98.00	OPTIONAL	N	
9	Slope % Seglen	%	10.00	OPTIONAL	N	
10	Min Slope Load	Lb	0.00	OPTIONAL	N	
11	Max Slope Load	Lb	10000.00	OPTIONAL	N	
12	Slope Min Strss	PSI	0.00	OPTIONAL	N	
13	Slope Max Strss	PSI	1000.00	OPTIONAL	N	
14	%Strain Point1	%	2.00	OPTIONAL	N	Rslt 27,29,31,33,35
15	%Strain Point2	%	5.00	OPTIONAL	N	Rslt 28,30,32,34,36
16	Elong Point1	In	0.10	OPTIONAL	N	Rslt 23,25
17	Elong Point2	In	0.10	OPTIONAL	N	Rslt 24,26
18	Stress Point1	PSI	100.0	OPTIONAL	N	Rslt 37,39

19	Stress Point2	PSI	200.0	OPTIONAL	N	Rslt 38,40
20	Yield Offset%		2	OPTIONAL	N	Rslt 16,17,18,19,20,21
21	Slack Pre-Load	Lb	5.00	OPTIONAL	N	
22	%Strain Point3	%	5.00	OPTIONAL	N	Rslt 46

Test Inputs:

#	Label	Units	Default	Attribute	Panel Input	Reference
0	Inital Speed	In/Min	2.00	DISPLAY	N	MSeg 3
1	Secondary Speed	In/Min	4.00	OPTIONAL	N	MSeg 4
2	% Strain Limit	%	100.0	OPTIONAL	N	MSeg 3
3	Deformation Lim	%	200.0	OPTIONAL	N	MSeg 4
4	Load Limit HI	Lb	25	DISPLAY	N	
5	Load Limit LO	Lb	-5000	OPTIONAL	N	
6	Ext Limit HI	mm	20.0	DISPLAY	N	
7	Ext Lmit LO	In	-20.0	OPTIONAL	N	
8	Strain Limit HI	%	3000000.1	OPTIONAL	N	
9	Strain Limit LO	%	-300000.0	OPTIONAL	N	
10	Stress Limit HI	PSI	2999999.9	OPTIONAL	N	
11	Stress Limit LO	PSI	-3000000	OPTIONAL	N	
12	# Cycles	(none)	20.0	OPTIONAL	N	
13	Time Limit	Sec	10000	OPTIONAL	N	
14	Brk Sensitivity	%	75	OPTIONAL	N	
15	RETURN Point	In	0.0	DISPLAY	N	

Required Markers

#	Category	Code	Attribute
1	BREAK POINT	F	MOVABLE
2	YIELD POINT	Y	MOVABLE
3	MODULUS BEGIN	B	MOVABLE
4	MODULUS END	M	MOVABLE

Optional Markers

#	Category	Code	Attribute	Formula	Inputs	Reference
5	AT MIDPOINT	0	HIDDEN			
6	AT PIP	1	HIDDEN			
7	AT PIP	2	HIDDEN			

8	AT PIP	3	HIDDEN		
9	AT PIP	4	HIDDEN		
10	FREE	5	HIDDEN	@INDEX(LOAD,PEAK)	
11	FREE	6	HIDDEN	@INDEX(LOAD,PEAK)	
12	FREE	7	HIDDEN	@INDEX(LOAD,PEAK)	
13	FREE	8	HIDDEN	@INDEX(LOAD,PEAK)	
14	FREE	9	HIDDEN	@INDEX(LOAD,PEAK)	

Required Calculations

#	Category	Procedure	Inputs
0	AREA	INACTIVE	
1	STRESS	1/AREA	
2	PRIMARY STRAIN	1/C00	C00
3	SECONDARY STRAIN	1/C00	C03
4	BREAK	INACTIVE	
5	YIELD POINT	INACTIVE	
6	PRIMARY SLOPE	INACTIVE	
7	SLACK COMPENSATION	INACTIVE	
8	OFFSET YIELD	INACTIVE	
9	GAGE LENGTH ADJUSTMENT	INACTIVE	C00

Result Calculations

#	Label	Category	Formula	Units	Attribute
0	Peak Load	FIXED	PEAKLOAD	Gm	DISPLAY

Upload and Sample Reports:

Free Form Sample Report	Fixed Report (1)
Free Form Upload Report	<None>
Upload Destination	COMM PORT
Upload Filename	DATA.TMP

Test Page Windows:

Show Load Meter	Y
Show Extension Meter	Y
Show Strain1 Meter	N
Show Strain2 Meter	N

Show Machine Status	N
Show Test Messages	N
Show Specimen Inputs	N
Show Description	N
Show Panel	N
Show Machine	Y
Show Multi-Display	N
Show Handset	Y
Show Ruler	N
Show Peaks	N

Ruler Defaults:

Ruler Maximum Up	40.000000
Ruler Maximum down	-40.000000
Ruler Control Mode	POSITION
Ruler Units	In
Ruler Gage Length	1.000000
Ruler Gage Length Units	In
Ruler Decimals Precision	1

Meter Defaults:

Load Meter Full Scale	100.000000
Load Meter Units	Lb
Load Meter Decimals	1
Load Meter Mode	DIGITAL
Extension Meter Full Scale	1.000000
Extension Meter Units	In
Extension Meter Decimals	1
Extension Meter Mode	DIGITAL
Strain1 Meter Full Scale	1.000000
Strain1 Meter Units	In
Strain1 Meter Decimals	1
Strain1 Meter Mode	ANALOG
Strain2 Meter Full Scale	1.000000
Strain2 Meter Units	In
Strain2 Meter Decimals	1
Strain2 Meter Mode	ANALOG

Peaks Defaults:	
Show Load Peak	Y
Load Units	Lb
Load Decimals	1
Show Extension Peak	Y
Extension Units	In
Extension Desimals	1
Show Strain Peak	Y
Strain Units	%
Strain Desimals	1
Show Stress Peak	Y
Strain Units	PSI
Strain Desimals	1
Show Cycle Count	Y
Panel End Action Defaults:	
Load End Action	STOP
Extension End Action	STOP
Strain End Action	STOP
Stress End Action	STOP

EXAMPLES

In each of the following examples, pairs of strap members for use with disposable absorbent undergarments were produced. Each strap member was formed of an elastomeric material comprising nylon, polyester and elastic materials, by Shelby Elastics of Shelby, North Carolina. A pair of buttons having a diameter of 22 mm. from Engineering Industries were sewn onto the opposite end regions of the strap members.

Example A

Each strap member of Example A included two nylon monofilament strands transversely laid in the surrounding fabric structure in a sinusoidal manner over a width of 31.8 mm. One monofilament strand was 180 denier and the other was 330 denier. The

strap material had a width of 38.1 mm. Each strap member was scissors cut to a length of 26.7 cm and had an ultrasonically formed end seal contiguous with each end edge. The end seal had a length of 3.2 mm. and a width of 38.1 mm. The buttons were separated by 24.1 cm. The gap between the end seal and the button attachment location was about 10 mm.

The deflection resistance of 1 test specimen from these strap members was measured and found to have a value of 19.4 grams. The test specimens had a width of 21 mm. and a length of 3.2 mm.

Example B

Each strap member of Example B included two nylon monofilament strands transversely laid in the surrounding fabric structure in a sinusoidal manner over a width of 31.8 mm. One monofilament strand was 80 denier and the other was 330 denier. The strap material had a width of 38.1 mm. Each strap member was ultrasonically cut to a length of 26.7 cm and had an ultrasonically formed end seal contiguous with each end edge. The end seal had a length of 3.2 mm. and a width of 31.8 mm. The buttons were separated by 24.1 cm. The gap between the end seal and the button attachment location was about 10 mm.

The deflection resistance of 1 test specimen from these strap members was measured and found to have a value of 14.7 grams. The test specimens had a width of 21 mm. and a length of 3.2 mm.

Example C

Each strap member of Example C included one 80 denier nylon monofilament strand transversely laid in the surrounding fabric structure in a sinusoidal manner over a width of 31.8 mm. The strap material had a width of 38.1 mm. Each strap member was scissors cut to a length of 26.7 cm and had an ultrasonically formed end seal contiguous with each end edge. The end seal had a length of 3.2 mm. and a width of 38.1 mm. The buttons were separated by 24.1 cm. The gap between the end seal and the button attachment location was about 10 mm.

The deflection resistance of 1 test specimen from these strap members was measured and found to have a value of 14.7 grams. The test specimens had a width of 21 mm. and a length of 3.2 mm.

Each of the strap members from Examples A through C were tested in combination with a disposable absorbent undergarment. The undergarment comprised a liquid impermeable moisture barrier, a spunbond polypropylene bodyside liner bonded to the moisture barrier, and an absorbent assembly sandwiched between the moisture barrier and the bodyside liner. The moisture barrier comprised an adhesive laminate of a polyethylene film inner layer and a spunbond nonwoven outer layer. The bodyside liner, absorbent assembly and moisture barrier were bonded together using a construction adhesive. The undergarment also included leg elastic members secured along the two side margins of the garment. Button holes with reinforcement tapes were provided generally in the four corners of the undergarment.

A fit study was conducted using 30 continent female panelists having hip sizes in the range of 119.4 to 152.4 cm. Applicants hypothesized that relatively large individuals would stress the suspension system most and would therefore be able to best differentiate strap functionality. Each panelist tested each of the Examples A through C strap members. Each panelist was advised to wear an undergarment with one pair of Example strap members overnight and through the following day, for a minimum of 16 hours, and return the next day for photographs and evaluations.

The qualitative results obtained from the above test indicate that the Example C strap members did not perform as well as the Examples A and B strap members. In particular, the Example C strap members exhibited more twisting and rolling of the side edges; increased chafing and rubbing near the buttons; greater irritation during the day; and an enhanced feeling of scratchiness near the buttons. It appears to Applicants that functionality improves as the monofilament size and number of strands increase.

Example D

Each strap member of Example D included two nylon monofilament strands transversely laid in the surrounding fabric structure in a sinusoidal manner over a width of 31.8 mm. One monofilament strand was 80 denier and the other was 330 denier. The strap material had a width of 38.1 mm. Each strap member was scissors cut to a length

of 28.6 cm and had an ultrasonically formed end seal contiguous with each end edge. The end seal had a length of 3.2 mm. and a width of 38.1 mm. The buttons were separated by 26 cm. The gap between the end seal and the button attachment location was about 10 mm.

The deflection resistance of 1 test specimen from these strap members was measured and found to have a value of 107.6 grams. The test specimens had a width of 21 mm. and a length of 3.2 mm.

Example E

Each strap member of Example E included two nylon monofilament strands transversely laid in the surrounding fabric structure in a sinusoidal manner over a width of 31.8 mm. One monofilament strand was 180 denier and the other was 520 denier. The strap material had a width of 38.1 mm. Each strap member was scissors cut to a length of 28.6 cm and had an ultrasonically formed end seal contiguous with each end edge. The end seal had a length of 3.2 mm. and a width of 38.1 mm. The buttons were separated by 26 cm. The gap between the end seal and the button attachment location was about 10 mm.

The deflection resistance of 1 test specimen from these strap members was measured and found to have a value of 146.4 grams. The test specimens had a width of 21 mm. and a length of 3.2 mm.

Example F

Each strap member of Example F included two nylon monofilament strands transversely laid in the surrounding fabric structure in a sinusoidal manner over a width of 31.8 mm. One monofilament strand was 180 denier and the other was 520 denier. The strap material had a width of 38.1 mm. Each strap member was scissors cut to a length of 26.7 cm and had an ultrasonically formed end seal contiguous with each end edge. The end seal had a length of 3.2 mm. and a width of 38.1 mm. The buttons were separated by 24.1 cm. The gap between the end seal and the button attachment location was about 10 mm.

The deflection resistance of Example F strap members should be similar to Example E strap members.

Each of the strap members from Examples D through F were tested in combination with disposable absorbent undergarments as described in relation to the testing of Examples A through C. A fit study was conducted using 12 continent female panelists having hip sizes in the range of 106.7 to 152.4 cm. Each panelist tested each of the Examples D through F strap members. Each panelist was advised to wear an undergarment with one pair of Example strap members overnight and through the following day, for a minimum of 16 hours, and return the next day for photographs and evaluations.

The qualitative results obtained from the test of Examples D through F suggest that an increase in the size of the monofilament contributes to a reduction in twisting and rolling.

Control Example G

Each strap member of Control Example G was representative of those sold by Kimberly-Clark Corporation of Neenah, Wisconsin, in about January of 1996 under the tradename DEPEND®. Each strap member had a width of 25.4 mm. and was scissors cut to a length of 26.0 cm. The straps had end seals that were contiguous with the end edges of the straps. Each end seal had a length of about 9.5 mm. and comprised a series of bar-shaped ultrasonic bond areas. The strap fibers were melt adhered to one another in the bond areas. Rather than being substantially continuous across the width of each end seal, the bond areas comprised only about 50 percent of the width of each end seal. The buttons were separated by 22.9 cm. and the gap between the end seals and the button attachment locations was about 5 mm.

The deflection resistance of 1 test specimen from these strap members was measured and found to have a value of 42.6 grams. The test specimens had a width of 21 mm. and a length of 9.5 mm.

Example H

Each strap member of Example H included two nylon monofilament strands transversely laid in the surrounding fabric structure in a sinusoidal manner over a width of 31.8 mm. One monofilament strand was 80 denier and the other was 330 denier. The strap material had a width of 38.1 mm. Each strap member was scissors cut to a length of 28.6 cm and had an ultrasonically formed end seal contiguous with each end edge. The end seal had a length of 19.1 mm. and a width of 38.1 mm. The buttons were separated by 25.4 cm. and bonded through the end seals so that there was no gap between the end seals and the button attachment locations.

The deflection resistance of 5 test specimens from these strap members were measured and found to have an average value of 1292 grams, with a standard deviation of 68.4 grams. The test specimens had a width of 21 mm. and a length of 19.1 mm.

Example I

Each strap member of Example I was similar to those of Example H except that the end seal had a length of 15.9 mm. The end seal resides essentially under the button leaving no gap between the end seal and the button attachment location. The deflection resistance of 5 test specimens from these strap members were measured and found to have an average value of 1117 grams, with a standard deviation of 116.7 grams. The test specimens had a width of 21 mm. and a length of 15.9 mm.

Example J

Each strap member of Example J was similar to those of Example H except that the end seal had a length of 12.7 mm. The gap between the end seal and the button attachment location was about 3 mm. The deflection resistance of 5 test specimens from these strap members were measured and found to have an average value of 836 grams, with a standard deviation of 20.4 grams. The test specimens had a width of 21 mm. and a length of 12.7 mm.

Example K

Each strap member of Example K was similar to those of Example H except that the end seal had a length of 9.5 mm. The gap between the end seal and the button attachment location was about 7 mm. The deflection resistance of 5 test specimens from these strap members were measured and found to have an average value of 667 grams, with a standard deviation of 47.4 grams. The test specimens had a width of 21 mm. and a length of 9.5 mm.

Each of the strap members from Control Example G and Examples H through K were tested in combination with disposable absorbent undergarments as described in relation to the testing of Examples A through C. A fit study was conducted using 12 continent female panelists having hip sizes in the range of 106.7 to 152.4 cm. Each panelist tested each of the Examples G through K strap members. Each panelist was advised to wear an undergarment with one pair of Example strap members overnight and through the following day, for a minimum of 16 hours, and return the next day for photographs and evaluations.

The qualitative results obtained from the test of Control Example G and Examples H through K suggest that the stiffened end seal itself and the gap between the end seal and the button attachment location are important factors in performance. Applicants theorize that irritation attributable to strap end curling tends to increase when the gap between the button attachment location and the end seal gets larger. In particular, as the gap increases beyond about 6 mm., the strap ends begin to curl under more which leads to noticeable redness and chafing/rubbing near the buttons. Additionally, when the button attachment location is placed through the end seal, that is a gap of zero, the straps begin to feel scratchy and there is again noticeable redness.

Example L

Each strap member of Example L included two nylon monofilament strands transversely laid in the surrounding fabric structure in a sinusoidal manner over a width of 31.8 mm. One monofilament strand was 80 denier and the other was 330 denier. The strap material had a width of 38.1 mm. Each strap member was scissors cut to a length of 28.6 cm and had an ultrasonically formed end seal contiguous with each end edge. The end seal had a length of 12.7 mm. and a width of 38.1 mm. The buttons were

separated by 25.4 cm. and the gap between the end seals and the button attachment locations was about 3 mm.

The deflection resistance of 10 test specimens from these strap members were measured and found to have an average value of 439 grams, with a standard deviation of 85.9 grams. The test specimens had a width of 21 mm. and a length of 12.7 mm.

Example M

Each strap member of Example M was similar to those of Example L except for the deflection resistance of the strap member. The deflection resistance of 10 test specimens from the Example M strap members were measured and found to have an average value of 227 grams, with a standard deviation of 44.2 grams. The test specimens had a width of 21 mm. and a length of 12.7 mm.

Example N

Each strap member of Example N was similar to those of Example L except for the deflection resistance of the strap member. The deflection resistance of 10 test specimens from the Example N strap members were measured and found to have an average value of 617 grams, with a standard deviation of 125.1 grams. The test specimens had a width of 21 mm. and a length of 12.7 mm.

Each of the strap members from Examples L through N were tested in combination with disposable absorbent undergarments as described in relation to the testing of Examples A through C. A fit study was conducted using 10 continent female panelists having hip sizes in the range of 109 to 152.4 cm. Each panelist tested each of the Example L through N strap members. Each panelist was advised to wear an undergarment with one pair of Example strap members overnight and through the following day, for a minimum of 16 hours, and return the next day for photographs and evaluations.

The qualitative results obtained from the test of Examples L through N suggest that end seal deflection resistance is an important characteristic for the strap members that were tested. The results indicate to Applicants that increased end seal stiffness reduced the amount that strap ends curled under and irritated the wearer. As end seal stiffness

decreased below that of Example L, increased levels of red marking, indentation, and irritation were observed. Further, the end seals of Example N were found to curl under significantly less that those of Example L, as determined by noting whether the end did not curl, curled at an angle up to 45 degrees, or curled at an angle of more than 45 degrees.

The foregoing detailed description has been for the purpose of illustration. Thus, a number of modifications and changes may be made without departing from the spirit and scope of the present invention. For instance, alternative or optional features described as part of one embodiment can be used to yield another embodiment. Additionally, two named components could represent portions of the same structure. Therefore, the invention should not be limited by the specific embodiments described, but only by the claims.

CLAIMS

We claim:

1. A fastening system for use with a garment, the fastening system comprising:

an elastomeric strap member having longitudinal and transverse axes, opposite first and second longitudinal end edges, opposite side edges extending between the end edges, a first end region contiguous with the first end edge, and a second end region contiguous with the second end edge, the elastomeric strap member comprising:

a fabric structure comprising a plurality of fabric strands; and

a monofilament strand transversely laid within the fabric structure, the monofilament strand having an effective width;

a button bonded to the strap member in the first end region and adapted for releasable attachment to the garment; and

means for attaching the second end region to the garment;

wherein the strap member further comprises an end seal contiguous with the first end edge, the end seal having a width dimension at least as great as the effective width of the monofilament strand and being substantially continuous across the width dimension, the fabric strands being bonded to one another in the end seal and the monofilament strand being substantially immobilized in the end seal.

2. The fastening system of claim 1, wherein the button is bonded to the strap member at an attachment location and the end seal is longitudinally spaced from the attachment location by a gap of not more than about 10 millimeters.

3. The fastening system of claim 2, wherein the gap is from 0 to about 6 mm.

4. The fastening system of claim 1, wherein the effective width of the monofilament strand is less than a strap width defined between the side edges of the strap member.

5. The fastening system of claim 4, wherein the width dimension of the end seal is less than the strap width.

6. The fastening system of claim 1, wherein the end seal has a length dimension of greater than 3 millimeters.

7. The fastening system of claim 6, wherein the end seal has a length dimension of at least about 10 millimeters.

8. The fastening system of claim 6, wherein the end seal has a deflection resistance value of at least about 200 grams.

9. The fastening system of claim 1, wherein the end seal has a deflection resistance value of at least about 200 grams.

10. The fastening system of claim 1, wherein the strap member comprises a plurality of monofilament strands.

11. The fastening system of claim 1, wherein the strap member has a strap width of at least about 30 millimeters.

12. The fastening system of claim 1, wherein the fabric strands are melt adhered to the monofilament strand.

13. A fastening system, comprising:

an elastomeric strap member having longitudinal and transverse axes, opposite first and second longitudinal end edges, opposite side edges extending between the end edges, a first end region contiguous with the first end edge, and a second end region contiguous with the second end edge, the elastomeric strap member comprising:

a fabric structure comprising a plurality of fabric strands; and

a monofilament strand transversely laid within the fabric structure, the monofilament strand having an effective width;

first and second buttons bonded to the strap member in the respective first and second end regions; and

wherein the strap member further comprises an end seal contiguous with each of the first and second end edges, each end seal having a width dimension at least as great as the effective width of the monofilament strand and being substantially continuous across the width dimension, the fabric strands being bonded to one another in each end seal and the monofilament strand being substantially immobilized in each end seal.

14. The fastening system of claim 13, wherein the buttons are bonded to the strap member at attachment locations and the end seals are longitudinally spaced from the attachment locations by gaps of not more than about 10 millimeters.

15. The fastening system of claim 13, wherein the gaps are from 0 to about 6 mm.

16. The fastening system of claim 13, wherein the effective width of the monofilament strand is less than a strap width defined between the side edges of the strap member.

17. The fastening system of claim 13, wherein the end seals have a length dimension of greater than 3 millimeters.

18. The fastening system of claim 13, wherein the end seals have a length dimension of at least about 10 millimeters.

19. The fastening system of claim 13, wherein the end seals have a deflection resistance value of at least about 200 grams.

20. An absorbent article, comprising:

a garment having first and second waist regions and an intermediate section which interconnects the waist regions, the garment defining a plurality of button holes in the first and second waist regions, the garment comprising a liquid-impermeable moisture barrier, an absorbent assembly disposed on the moisture barrier, and a liquid-permeable bodyside liner bonded to the moisture barrier and sandwiching the absorbent assembly between the bodyside liner and the moisture barrier;

a pair of elastomeric strap members, each of the strap members having longitudinal and transverse axes, opposite first and second longitudinal end edges, opposite side edges extending between the end edges, a strap width defined between the side edges, a first end region contiguous with the first end edge, a second end region contiguous with the second end edge, and a central region intermediate and interconnecting the first and second end regions, each elastomeric strap member comprising:

a fabric structure comprising a plurality of fabric strands; and

a monofilament strand transversely laid within the fabric structure, the monofilament strand having an effective width;

first and second buttons bonded to each of the strap members in the respective first and second end regions, the buttons adapted for releasable attachment to the button holes; and

wherein each of the strap members further comprises an end seal contiguous with each of the first and second end edges, each end seal having a width dimension at least as great as the effective width of the monofilament strand and being substantially continuous across the width dimension, the fabric strands being bonded to one another in each end seal and the monofilament strand being substantially immobilized in each end seal.

21. The absorbent article of claim 20, wherein the buttons are bonded to the strap members at attachment locations and the end seals are longitudinally spaced from the attachment locations by gaps of from 0 to about 6 mm.

22. The absorbent article of claim 20, wherein the end seals have a length dimension of greater than 3 millimeters.

23. The absorbent article of claim 20, wherein the end seals have a deflection resistance value of at least about 200 grams.

24. A method of making a strap member, comprising the steps of:

providing a continuous web of elastomeric strap material comprising a fabric structure and a monofilament strand transversely laid within the fabric structure in a sinusoidal manner;

treating discrete regions of the continuous web to form a plurality of bonded areas wherein the fabric structure is bonded to itself to immobilize the monofilament strand, each bond area having a length of at least 6 millimeters;

transversely cutting the continuous web through the bonded areas to form a plurality of strap members, each strap member having opposite end edges with a portion of the bond area defining an end seal contiguous with each end edge, each end seal having a length of at least 3 millimeters and a deflection resistance value of greater than 200 grams; and

bonding a pair of buttons on each strap member.

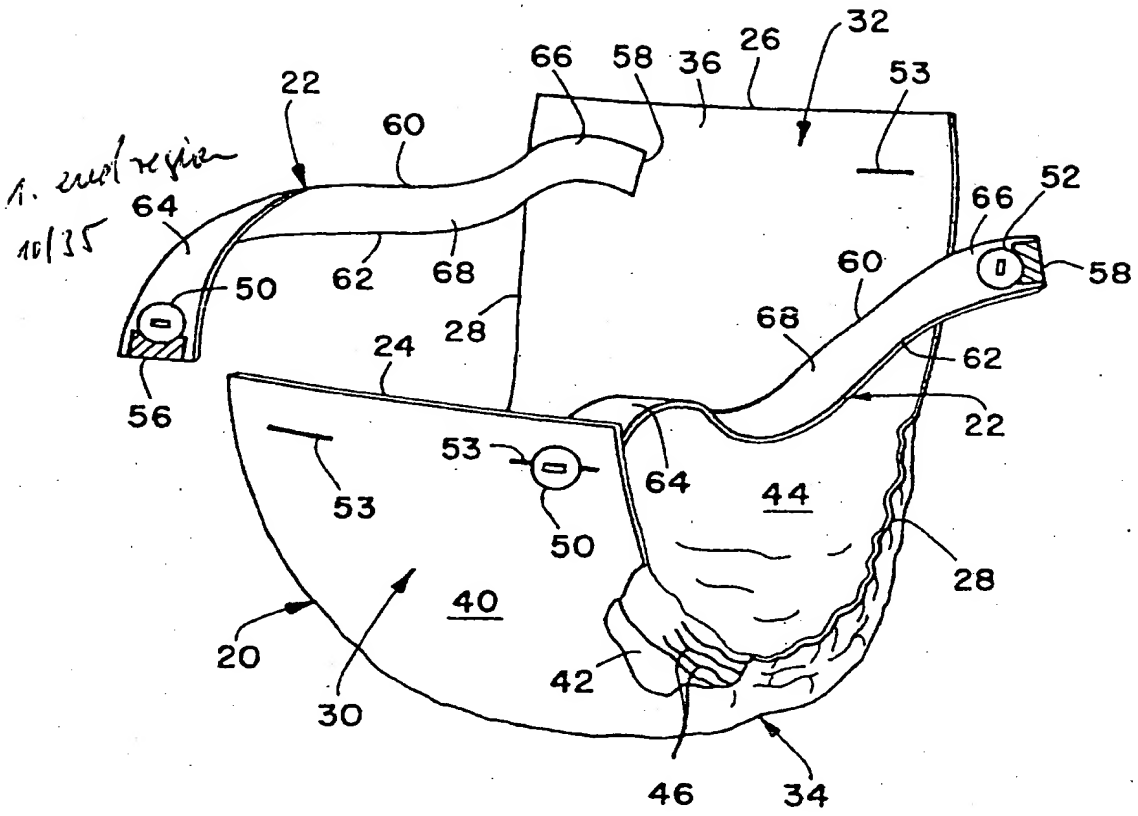
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FIG. 1

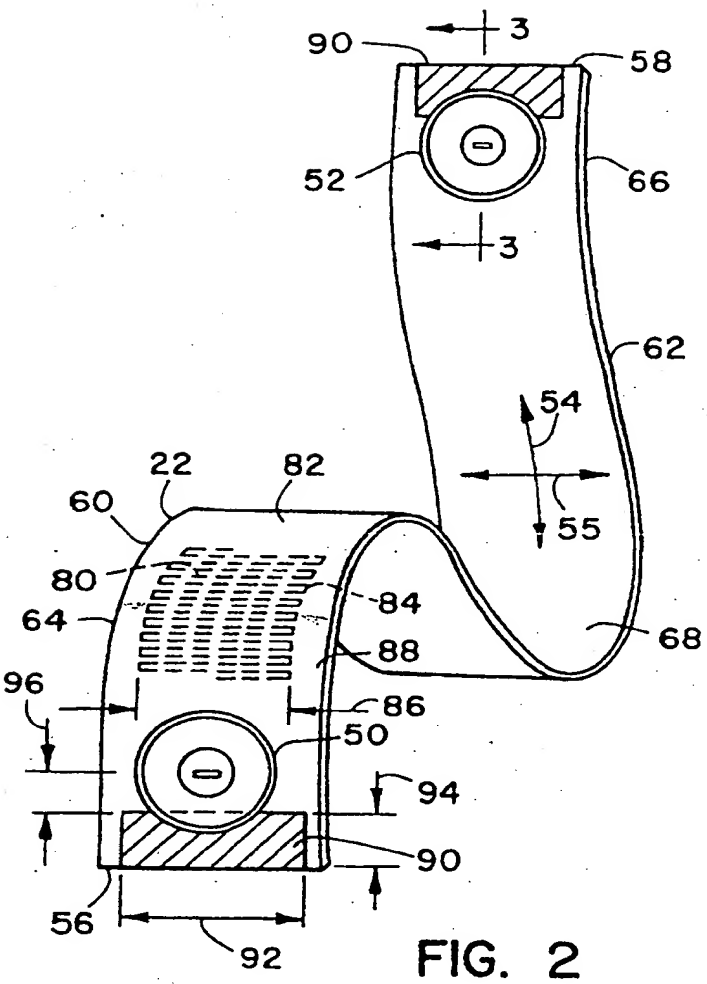
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FIG. 2

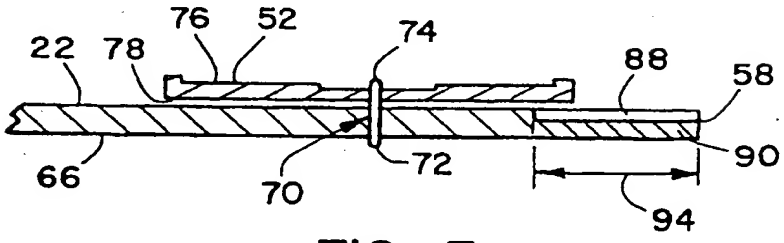
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FIG. 3

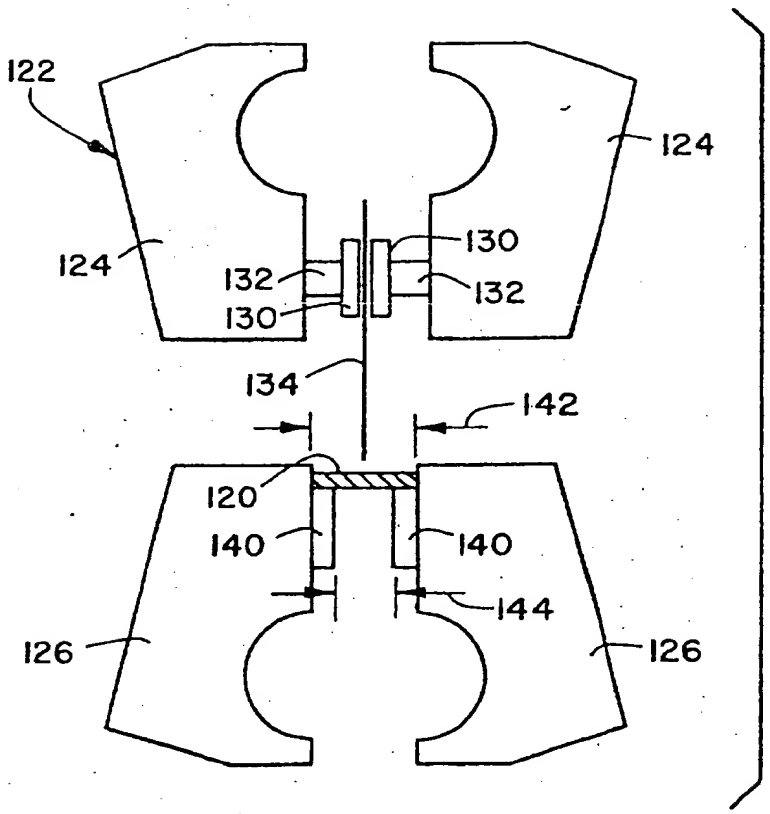

FIG. 4

INTERNATIONAL SEARCH REPORT

In ional Application No
PCT/US 97/05790

A. CLASSIFICATION OF SUBJECT MATTER
IPC 6 A61F13/64

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 6 A61F A41F A41D B29C

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	EP 0 617 941 A (KIMBERLY-CLARK CORPORATION) 5 October 1994 see column 7, line 7 - column 8, line 11; figures 1,3-5 ---	1,13,20, 24
A	US 4 631 932 A (S.R.C. TEXTILES INC.) 30 December 1986 cited in the application see column 3, line 38 - line 46; claim 1; figure 2 ---	1
A	US 4 384 908 A (W. E. KLEIST) 24 May 1983 see column 1, line 49 - line 54; claims 1,4; figures 1-13 -----	24

[ ] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

* Special categories of cited documents :

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"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

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"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
30 July 1997	06.08.97

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+ 31-70) 340-2040, Tx. 31 651 epo nl, Fax (+ 31-70) 340-3016	Garnier, F

Form PCT/ISA/210 (second sheet) (July 1992)

INTERNATIONAL SEARCH REPORT

.nformation on patent family members

Int nal Application No
PCT/US 97/05790

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